Practice Questions for Validation Exam for MA1115

Show your work and circle your answers. No calculators allowed.

1. Given the parametric curve

$$x = e^t \quad , \quad y = \sin(2t)$$

Find the equation for the line tangent to the curve at the point where $t = 0$.

2. Express the vector $\mathbf{B} = 5\,\mathbf{i} - 2\,\mathbf{j} - 3\,\mathbf{k}$ as the sum of a vector $\mathbf{B}_1$ parallel to $\mathbf{A} = 2\,\mathbf{i} + 2\,\mathbf{j} + \mathbf{k}$ and a vector $\mathbf{B}_2$ orthogonal to $\mathbf{A}$.

3. Suppose you are walking on a surface given by:

$$z = \sin(\pi xy) - y^2 + \ln(1 + x)$$

If you start at the point $(x, y) = (2, 1)$ and walk northeast (where x is east and y is north), how steep, uphill or downhill, is your path at that point?

4. Find all relative maxima, minima, and saddle points of $f(x, y)$ below:

$$f(x, y) = y^4 + 2x^2 + 4xy$$

5. Evaluate the given double integral. (Hint: start by changing the order of integration.)

$$\int_0^1 \int_x^{x^{1/3}} e^{y^2}\, dy\, dx$$

6. Convert the given triple integral to spherical coordinates, then evaluate the resulting triple integral.

$$\int_0^{\sqrt{2}} \int_x^{\sqrt{4-x^2}} \int_0^{\sqrt{4-x^2-y^2}} (xz)\, dz\, dy\, dx$$